So, here we are

Etelab
we test

Test report

No.: 016-001-2020

Equipment under test (EUT): School RVU

Customer: 21stopni Sp. z o.o.

ETELAB s.r.o.
Fáblovka 552, Polabiny
533 52 Pardubice
Tel.: +420 467 070 262, E: info@etelab.cz
Testing laboratory accredited by CAI
according to ČSN EN ISO/IEC 17025:2015

ilac-MRA

L 1579

1. SUMMARY

The measurements have been performed according to Standard / used method:

EN 13141-7 Ventilation for buildings – performance testing of components/products for residential ventilation – Part 7: Performance testing of a mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for single family dwellings
EN 308 - Heat exchangers - Test procedures for establishing performance of air to air and flue gases heat recovery devices
EN ISO 5167-2 - Measurement of liquid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 2: Orifice plates
EN ISO 3744 - Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane
EN ISO 5136 - Acoustics - Determination of sound power radiated into a duct by fans and other air-moving devices - In-duct method

1.1. Participants

Customer 21stopni sp. z o.o.
ul. Majdan Kozłowicki 32
21-100 Majdan Kozłowicki
POLSKA

1.2. Order

The order with the number 20-ELZ016 has been executed according to the contract “Product tests and services”, dated 13.06.2020

1.3. Description of the tests

Delivery date	14.07.2020
Testing starts	15.07.2020
Testing ends	08.09.2020
Testing laboratory	ETELAB

Climatic conditions during tests	Ambient temperature:	23,5 °C
	Relative humidity:	53,6 %
	Atmospheric pressure:	99300 kPa

1.4. Identification of the EUT

HEAT RECOVERY UNIT

Manufacturer	21stopni sp. z o.o.
Model	School RVU
Voltage	230 V / 50 Hz
Power	920 W
Weight	78 kg
SN	000000001
Year of manufacture	2020

Duct connections: ø 250 mm

EC fans, filters F9/M5, heat exchanger

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1.5. Specification of the measuring devices / instruments

Central unit	ALMEMO 5990-2 A03110153
Temperature sensors	FPA 10L0250 G5 ZA9030-FS2 (-200…+600°C, 0,01°C)
	FPA 10L0250 G5 ZA9030-FS2 (-200…+600°C, 0,01°C)
	FPA 10L0250 G5 ZA9030-FS2 (-200…+600°C, 0,01°C)
	FPA 10L0250 G5 ZA9030-FS2 (-200…+600°C, 0,01°C)
	FPA 10L0250 G5 ZA9030-FS2 (-200…+600°C, 0,01°C)
	FPA 10L0250 G5 ZA9030-FS2 (-200…+600°C, 0,01°C)
	FPA 10L0250 G5 ZA9030-FS2 (-200…+600°C, 0,01°C)
	FPA 10L0250 G5 ZA9030-FS2 (-200…+600°C, 0,01°C)
	FPA 22L0250 ZA 9030-FS1 (-200…+600°C, 0,01°C)
	FPA 22L0250 ZA 9030-FS1 (-200…+600°C, 0,01°C)
	FPA 22L0250 ZA 9030-FS1 (-200…+600°C, 0,01°C)
	FPA 22L0250 ZA 9030-FS1 (-200…+600°C, 0,01°C)
	FPA 22L0250 ZA 9030-FS1 (-200…+600°C, 0,01°C)
	FPA 22L0250 ZA 9030-FS1 (-200…+600°C, 0,01°C)
	FPA 22L0250 ZA 9030-FS1 (-200…+600°C, 0,01°C)
	FPA 22L0250 ZA 9030-FS1 (-200…+600°C, 0,01°C)
Pressure sensors:	FDA602-S1K SN: 07080441 (±1250Pa, ±0,5%)
	FDA602-S1K SN: 07080444 (±1250Pa, ±0,5%)
	FDA602-S1K SN: 07080425 (±1250Pa, ±0,5%)
	FDA602-S1K SN: 11060353 (±1250Pa, ±0,5%)
	FDA602-S1K SN: 11060354 (±1250Pa, ±0,5%)
	FDA602-S1K SN: 11060358 (±1250Pa, ±0,5%)
	FDA602-S1K SN: 14110505 (±1250Pa, ±0,5%)
	FDA602-S1K SN: 14110509 (±1250Pa, ±0,5%)
	FDA602-S1K SN: 09120662 (±1250Pa, ±0,5%)
	FDA602-S1K SN: 09120653 (±1250Pa, ±0,5%)
	FDA602-S1K SN: 09070435 (±1250Pa, ±0,5%)
Atmospheric pressure sensor	FDA 612-SA SN: 08010027 (700…1050mbar, ±0,5%)
Sensor humidity/temperature	FHA646-E2C SN:07100861
	FHA646-E2C SN:07100860
	FHAD462L10 SN:11060022
	FHAD462L10 SN:11060023
	FHAD462L10 SN:11060025
	FHAD462L10 SN:11070026
	FHAD462L10 SN:11070028
	FHAD462L10 SN:11070029
	FHAD462L10 SN:11070030
	FHAD462L10 SN:11070032
	FHAD462L10 SN:11070031
	FHAD462L10 SN:11070033
Orifice plate	MATTECH 200/150 SN: 72124
	MATTECH 200/150 SN: 72125
Input power meter	Hioki 3169-20 SN: 080804922
	Hioki 9694 SN: 080732278 (0…5A AC, ± 0,3 %)
Sound level meter	SINUS Apollo SN: 7777
Microphone	MV 210 SN: 3847

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2. TEST RESULTS

2.1. Operational range and flow rates for the test

Airflow 100%			
Pressure	Pressure at 1,2	Orifice	Airflow
(Pa)	(Pa)	(Pa)	(m^3/h)
5	5	352	1295
102	103	302	1192
204	206	262	1099
300	303	212	977
400	404	169	862
501	506	111	702
602	608	66	533
699	706	22	299
869	878	0	0

Table -1-

Values corrected for standard condition (t=20°C, ρ= 1,2 kg/m³)

Airflow 60%			
Pressure	Pressure at 1,2	Orifice	Airflow
(Pa)	(Pa)	(Pa)	(m^3/h)
3	3	189	990
101	102	139	802
200	202	99	666
301	304	47	450
398	402	6	144
455	460	0	0

Table -2-

Airflow 40%			
Pressure	Pressure at 1,2	Orifice	Airflow
(Pa)	(Pa)	(Pa)	(m^3/h)
1	1	57	522
25	25	49	478
52	53	37	416
73	74	25	339
100	101	15	260
124	126	6	157
160	162	0	0

Table -3-

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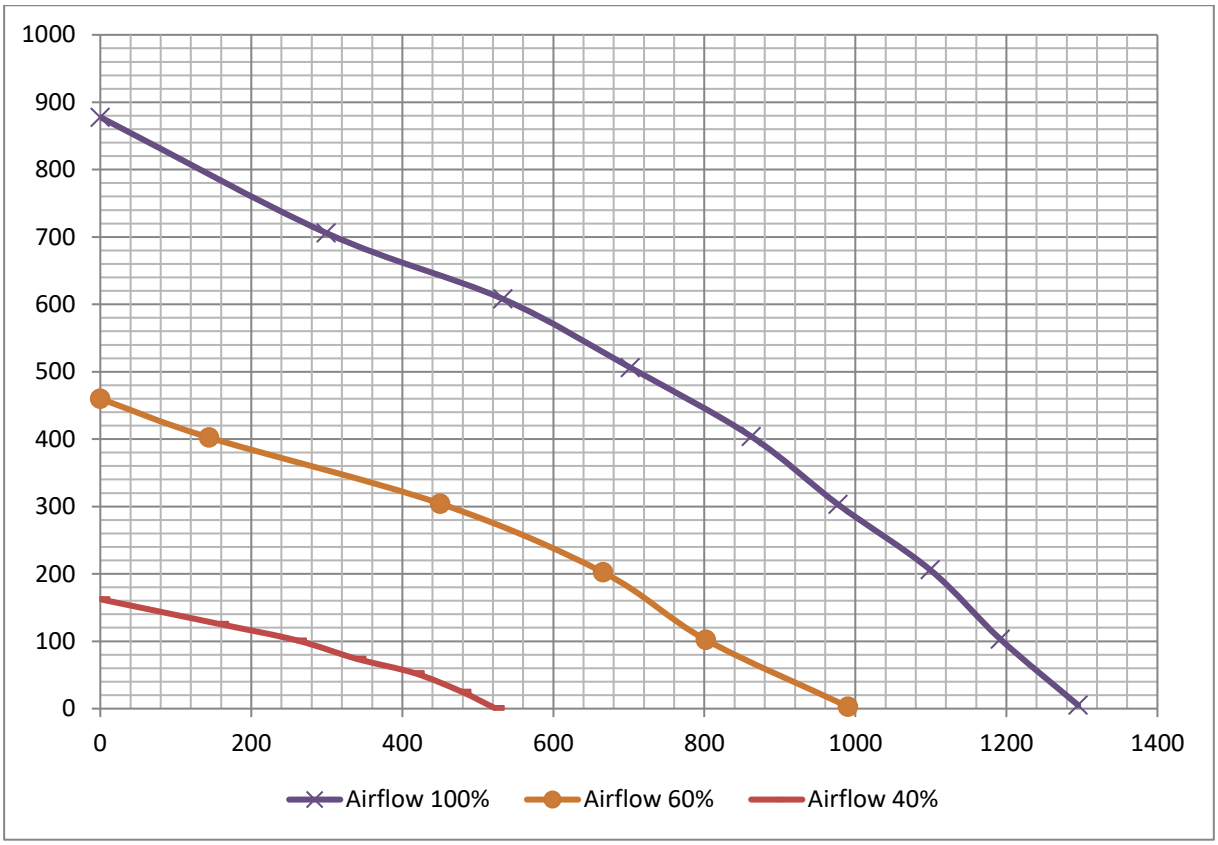
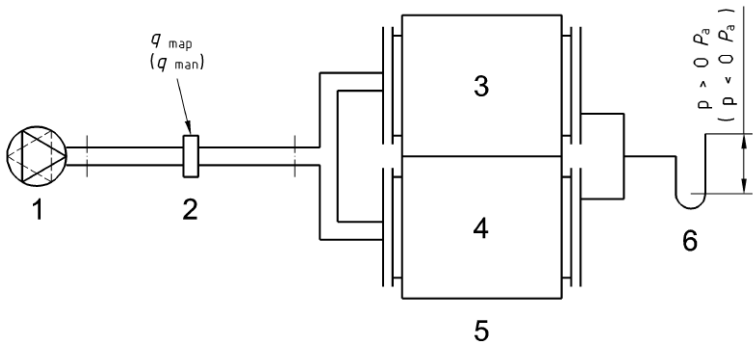


Chart -1-

2.2. Leakage according to EN 308

External leakage



Key

1 adjustable fan
2 air flow measuring equipment
3 exhaust air side
4 supply air side
5 heat recovery device
6 static pressure measuring equipment

Figure -1-

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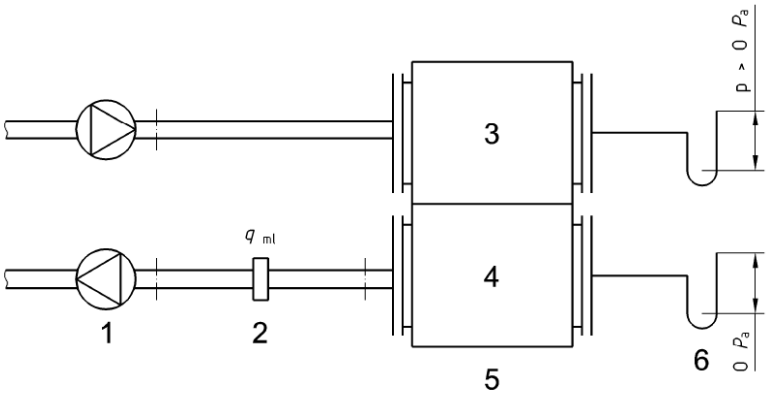
Test pressure	Leak volume flow	Leakage
(Pa)	(m^3/h)	(%)
-250	24,54	4,3%
-139	15,80	2,8%
-100	13,40	2,4%
-50	7,20	1,3%
0	0,00	0,0%
50	9,40	1,7%
100	15,00	2,7%
123	16,20	2,9%
250	23,44	4,1%

Table -4-

Internal leakage



Key

1 adjustable fan
2 air flow measuring equipment
3 exhaust air side
4 supply air side
5 heat recovery device
6 static pressure measuring equipment

Figure -2-

Test pressure	Leak volume flow	Leakage
(Pa)	(m^3/h)	(%)
-50,00	39,00	6,9%
-16,00	27,00	4,8%
0,00	0,00	0,0%
20,00	31,50	5,6%
47,00	44,00	7,8%

Table -5-

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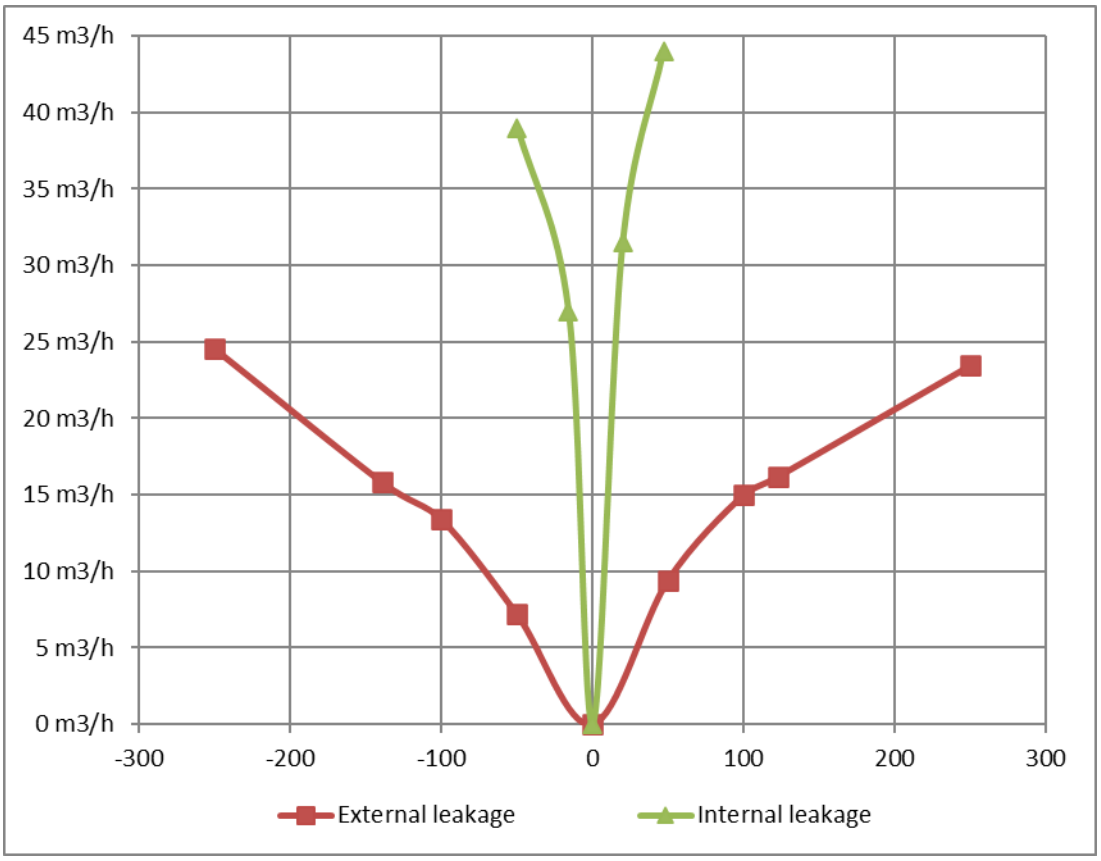

Chart -3-

2.3. Thermal efficiency according to EN 308

t – temperature measurement
h – humidity measurement
q – air-flow measurement
p – pressure measurement

21 – Outdoor air - ODA
22 – Supply air - SUP
11 – Extract air - ETA
12 – Exhaust air - EHA

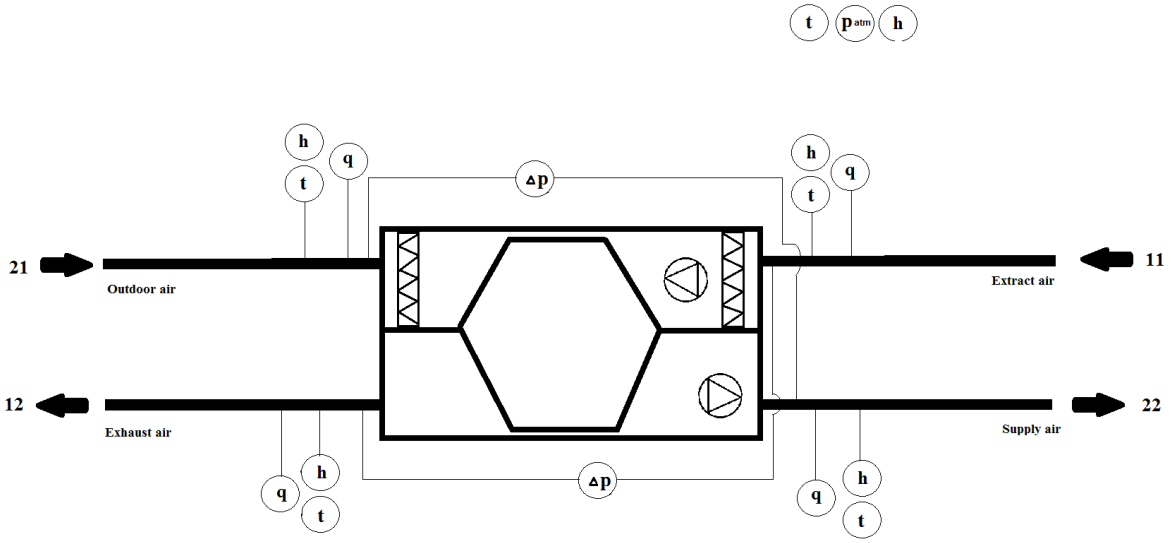

Figure -3-

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Airflow	q_{v11}	q_{m11}	t_{11}	φ_{11}	x_{11}	ρ_{11}	t_{12}	φ_{12}	x_{12}	ρ_{12}	η_t
	m^3/h	kg/h	°C	%rH	g/kg	kg/m^3	°C	%rH	g/kg	kg/m^3	%
40%	511	583	25,1	19,2	3,7	1,16	10,3	42,1	3,3	1,23	**83,3%**
60%	921	1050	24,9	19,4	3,7	1,16	10,2	42,5	3,3	1,23	**80,7%**
100%	1264	1441	25,3	19,5	3,8	1,16	11,5	40,5	3,3	1,23	**78,7%**

Airflow	q_{v21}	q_{m21}	t_{21}	φ_{21}	x_{21}	ρ_{21}	t_{22}	φ_{22}	x_{22}	ρ_{22}	p_{baro}
	m^3/h	kg/h	°C	%rH	g/kg	kg/m^3	°C	%rH	g/kg	kg/m^3	Pa
40%	480	522	5,0	63,8	3,3	1,25	21,8	24,7	3,9	1,18	999
60%	901	999	4,9	61,2	3,2	1,25	21,1	24,5	3,7	1,18	999
100%	1233	1386	5,2	61,4	3,3	1,25	21,0	25,2	3,7	1,18	999

Table -6-

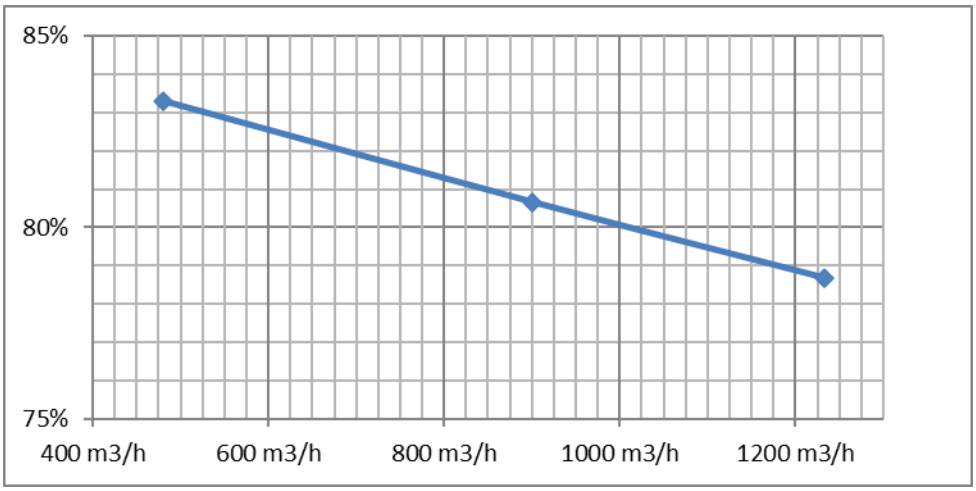

Chart -4-

2.4. Noise radiated trough the casing of the unit according to EN ISO 3744

Measurement work-station was on concrete surface in a room of dimensions -
length: 10,5m; width: 9m; height: 3,9m. Noise absorbability was calibrated by use of reference fan according to ISO 3744 standard, correction K2=1,5 dB.

Operation conditions of the noise source during the test: unit was located on the ground.
Connected duct 1mm steel, isolated 50 mm mineral wool.

Measurement of acoustic pressure levels: acoustic output has been measured on parallelepiped object in 1 m distance.

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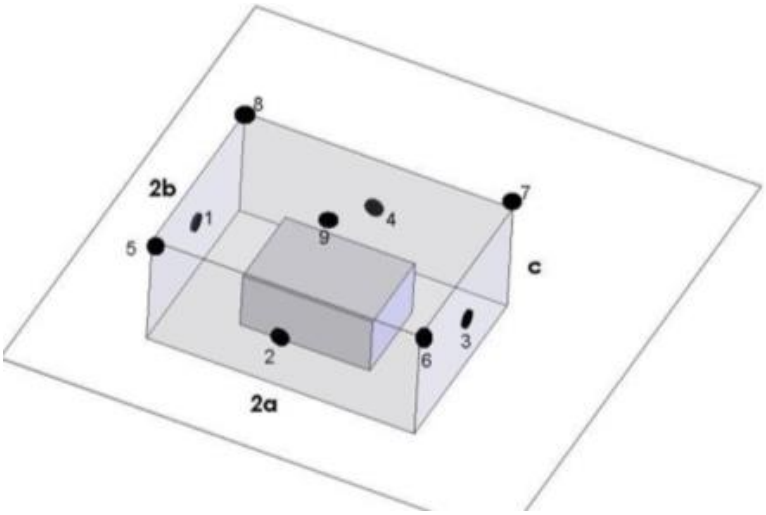

Figure -4- Position microphones

Sound power of noise sources 100% airflow																								
frek	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1,25 kHz	1,6 kHz	2 kHz	2,5 kHz	3,15 kHz	4 kHz	5 kHz	6,3 kHz	8 kHz	10 kHz	L_{WA}
L_{WA}=	48,8	47,9	51,2	55,2	56,6	54,6	53,8	53,7	54,7	54,9	54,5	53,4	50,6	51,2	48,0	47,6	46,9	46,6	43,7	42,2	38,7	34,4	28,9	21,8	**65,4**
Sound pressure in distance 3m Q=2																								
frek	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1,25 kHz	1,6 kHz	2 kHz	2,5 kHz	3,15 kHz	4 kHz	5 kHz	6,3 kHz	8 kHz	10 kHz	L_{PA}
L_{PA}=	31,2	30,4	33,7	37,6	39,1	37,1	36,3	36,2	37,2	37,4	37,0	35,9	33,1	33,7	30,5	30,1	29,4	29,1	26,2	24,6	21,1	16,9	11,4	4,3	**47,9**

Sound power of noise sources 60% airflow																								
frek	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1,25 kHz	1,6 kHz	2 kHz	2,5 kHz	3,15 kHz	4 kHz	5 kHz	6,3 kHz	8 kHz	10 kHz	L_{WA}
L_{WA}=	41,4	40,8	44,1	46,8	48,3	46,5	45,6	45,5	46,5	47,2	46,3	45,2	43,2	43,5	40,0	40,0	39,9	38,5	34,2	31,7	28,9	24,5	18,2	14,5	**57,3**
Sound pressure in distance 3m Q=2																								
frek	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1,25 kHz	1,6 kHz	2 kHz	2,5 kHz	3,15 kHz	4 kHz	5 kHz	6,3 kHz	8 kHz	10 kHz	L_{PA}
L_{PA}=	23,9	23,3	26,6	29,2	30,8	29,0	28,0	27,9	29,0	29,7	28,8	27,7	25,6	26,0	22,5	22,5	22,4	21,0	16,6	14,2	11,3	7,0	0,6	0,1	**39,8**

Sound power of noise sources 40% airflow																								
frek	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1,25 kHz	1,6 kHz	2 kHz	2,5 kHz	3,15 kHz	4 kHz	5 kHz	6,3 kHz	8 kHz	10 kHz	L_{WA}
L_{WA}=	35,9	34,2	37,8	39,2	40,2	38,2	37,3	37,6	38,9	39,5	38,8	37,7	35,8	36,2	32,8	32,9	31,4	28,9	24,7	22,4	19,3	15,6	12,3	18,4	**49,7**
Sound pressure in distance 3m Q=2																								
frek	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1,25 kHz	1,6 kHz	2 kHz	2,5 kHz	3,15 kHz	4 kHz	5 kHz	6,3 kHz	8 kHz	10 kHz	L_{PA}
L_{PA}=	18,4	16,6	20,3	21,7	22,7	20,7	19,8	20,1	21,4	22,0	21,3	20,2	18,3	18,7	15,3	15,4	13,9	11,4	7,2	4,8	1,8	1,7	1,3	0,9	**32,2**

Table -7-

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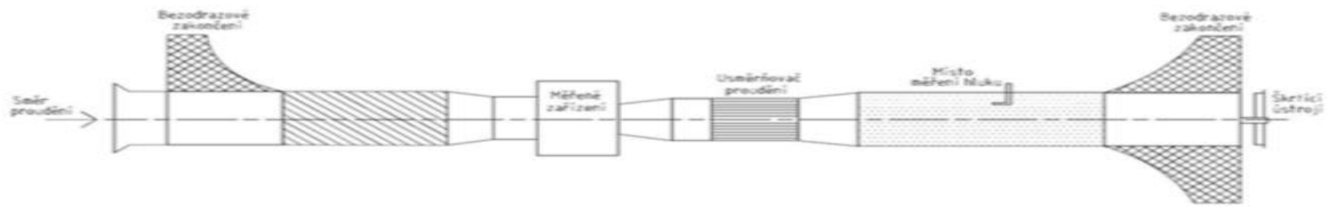
2.5. Sound power level in duct connections of the unit according to EN ISO 5136

Measurement point in 200 mm diameter ducting, measure points is 50 mm distance from the center of the ducting. Measured in three points at 120°

Description of the sources used during tests - noise of a fan and flowing air



Flow direction | Non-reflection end | Measured equipment | Air flow rectifier | Noise measurement | Non-reflection end | Throttle point

Figure -5- Noise in duct

SUPPLY			Sound power of noise sources																						
Run	Pressure	Airflow	freq	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1,25 kHz	1,6 kHz	2 kHz	2,5 kHz	3,15 kHz	4 kHz	5 kHz	6,3 kHz	8 kHz	10 kHz	L_{WA}
				(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)
100%	300 Pa	1190 m3/h	L_{WA}	55,5	58,8	60,2	62,1	63,3	64,1	64,8	65,5	65,8	66,6	65,4	65,4	65,3	65,3	64,5	64,1	63,1	62,0	61,0	60,2	58,4	58,8	57,3	50,3	**77,0**
	400 Pa	1095 m3/h	L_{WA}	56,3	59,7	60,9	62,9	64,5	65,6	66,2	66,9	67,0	67,5	66,5	66,4	66,2	66,2	65,2	64,8	64,0	63,0	62,0	61,5	60,2	60,0	58,4	52,0	**78,1**
	500 Pa	985 m3/h	L_{WA}	56,1	60,3	61,7	63,9	65,0	66,3	67,2	67,7	67,6	67,9	67,2	67,0	66,7	66,6	65,7	65,3	64,4	63,6	62,3	61,7	60,6	60,4	58,7	52,2	**78,7**
	600 Pa	870 m3/h	L_{WA}	55,6	60,1	61,1	62,8	64,3	65,1	65,9	66,2	66,0	66,2	65,6	65,4	65,2	64,9	63,4	63,2	62,4	61,8	60,1	59,0	58,2	58,6	55,7	48,8	**77,1**
	700 Pa	710 m3/h	L_{WA}	55,7	60,0	61,0	63,1	64,6	65,3	66,2	66,7	67,2	66,5	65,8	65,9	65,6	65,4	63,8	63,6	62,8	62,2	60,4	59,1	58,1	58,7	55,5	48,3	**77,5**
	800 Pa	480 m3/h	L_{WA}	54,1	58,7	58,1	59,0	59,7	60,2	61,0	64,6	66,9	62,7	61,9	62,9	64,0	62,8	61,9	61,2	60,3	59,6	57,0	55,3	54,8	55,0	51,5	44,7	**74,7**

EXTRACT			Sound power of noise sources																									
Run	Pressure	Airflow	frek	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1,25 kHz	1,6 kHz	2 kHz	2,5 kHz	3,15 kHz	4 kHz	5 kHz	6,3 kHz	8 kHz	10 kHz	L_{WA}
				(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)	(dB_A)
100%	300 Pa	1190 m3/h	L_{WA}	46,7	50,4	47,7	51,6	52,4	51,3	54,7	56,8	54,9	58,9	52,9	54,2	56,4	58,2	59,5	60,5	61,6	61,2	58,8	56,4	55,7	61,0	61,2	49,3	**71,1**
	400 Pa	1095 m3/h	L_{WA}	46,1	50,7	46,9	51,1	51,5	50,5	54,1	56,6	54,4	60,3	53,5	54,5	56,5	58,3	59,9	60,3	61,2	60,5	57,9	55,8	55,0	60,0	60,4	48,7	**70,9**
	500 Pa	985 m3/h	L_{WA}	46,7	52,1	46,1	50,1	50,1	49,9	53,5	55,7	53,6	58,1	53,6	54,1	55,9	57,7	59,3	59,3	59,7	58,9	56,4	54,4	53,9	57,5	58,7	47,2	**69,6**
	600 Pa	870 m3/h	L_{WA}	46,5	52,9	46,4	50,4	50,3	50,0	53,8	56,6	54,5	58,9	54,4	54,6	56,3	58,0	59,0	58,6	59,0	57,7	55,4	53,8	53,8	54,9	54,2	44,1	**69,2**
	700 Pa	710 m3/h	L_{WA}	47,3	53,6	47,1	50,9	50,1	50,7	55,2	59,0	57,1	59,2	55,2	55,5	56,9	58,7	59,0	58,5	58,8	57,2	55,1	53,8	54,3	55,0	54,2	44,7	**69,7**
	800 Pa	480 m3/h	L_{WA}	47,7	51,2	48,9	52,9	51,8	52,5	57,8	64,3	60,4	60,5	58,0	57,5	58,4	58,8	58,2	58,4	59,0	57,7	55,2	53,9	54,8	55,5	54,0	45,4	**71,2**

Table -8-

3. Formulation of the measurement uncertainty

U (flow rate) = 2 %
U (temperature) = 0,2 °C
U (humidity) = 2 %
U (pressure) = 1,5 %
U (noise casing) = 1,1 dB
U (noise duct) = 3,2 dB

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, which for a normal distribution provides a level of confidence of approximately 95%.

4. Non-accredited tests

Non-accredited tests: None

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5. Conclusions

Tested sample (EUT) did not change its function properties after the testing.

Test results described in this test report are related just to the tested samples (EUT)

The electronically recorded data will be stored for a period of 3 years. The test report and all the related documents will be kept 10 years. During this time the customer has the possibility to look into these documents. Copies will be charged.

Date October 5, 2020

Tests held by	Jan Stránský	Signature
Tests evaluated by	Pavel Hornych	Signature
Report approved by	Pavel Hornych – Head of laboratory	Signature

Accredited testing laboratory 1579 ETELAB

----------The end of the test report ----------

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